Annual Report

RELATIONSHIPS BETWEEN MOISTURE TRANSPORT AND PRECIPITATION DURING THE NORTH AMERICAN MONSOON

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INTRODUCTION
The work summarized below has been conducted over the past year (October 2002-September 2003). Activities were focused in two general areas: (i) development of radiosonde archives for the validation of wind and moisture analyses produced by NCEP and (ii) studies of relationships between Gulf of California moisture surges and precipitation in southwestern North America. Our specific research activities included:

(1) Validate mean wind, humidity and moisture transport fields in NCEP global and regional analyses in the NAME domain.

(2) Estimate components of the moisture budget in the core North American monsoon region.

(3) Diagnostic studies of relationships between moisture transport and precipitation in the core North American monsoon region.

Overall project goals and methodology are discussed in the original proposal and in various publications listed below.

PROPOSED WORK AND ACCOMPLISHMENTS (October 2002-September 2003)

The summary below is keyed to tasks listed in the original proposal.

Task 1.1 Build station climatologies of wind, moisture transport and precipitation.

Five different archives of radiosonde data were unpacked, processed, analyzed and written in common formats. These data are used for Tasks 2.1 and 2.3.

1. NCDC CD-ROM archive (1948-1998).

Comments: Originally written in FSL format. Many significant levels for the latter years have either winds or humidity/temperature as undefined values.

2. Creighton University / Mexican Weather Service archives:

Archive 1 from CD-ROM (1948-1998).
Comments: Almost identical to NCDC CD-ROM archive data.
Known deficiencies: units for wind speed are m/s while values are in knots; data are for 00Z and 12Z only.

Archive 2 (1989-2000)
Comments: These are original telegram messages in MS Excel format. Unlike Archive 1, this contains data from launches other then at 00Z or 12Z.
Known deficiencies: significant TB levels do not contain wind information, and significant PB levels don't contain temperature/humidity and pressure information.

Archive 3 (1999-2002)
Comments: Continuation of Archive 2. Overlapping data are absolutely identical.

3. FSL data (January - July 2003)
Comments: These data are a pre-quality controlled version of the NCDC data archive. Most significant levels have either winds or humidity/temperature as undefined values.

Daily station time series were built for 1948 - 2003 (July) for mandatory levels and vertically integrated. Parameters include temperature, humidity, wind components, and vapor transport components separately for 00Z and 12Z.

Task 1.3 Compute uncertainties in the NCEP/NCAR Global Reanalysis and the NCEP Regional Reanalyses

Will be completed as soon as the Regional Reanalysis data are archived and available at CPC.

Task 1.4 Compute uncertainties in the NCEP Eta Model Data Assimilation System (EDAS).

Model Location Time Series (MOLTS) are used to evaluate uncertainties in EDAS humidity, winds and vapor fluxes. MOLTS archives were transferred to new tapes for January 1998 - December 2002. MOLTS archives were decoded, parameters extracted and vapor fluxes calculated for November 1997 - December 2001. These data have been processed in separate data streams for 00Z and 12Z to satisfy the requirements of Task 2.3.

Task 2.1. Estimate the daily moisture budget for Mexico from observations.

As part of Task 1.1, historical daily radiosonde data were processed into vertically integrated vapor fluxes to calculate vapor flux convergence over the core monsoon region. Separate data streams were created for 00Z and 12Z and all observation times to satisfy the requirements of Task 2.3.

Task 2.3 Estimate uncertainty in the moisture budget in the EDAS using MOLTS and gridded fields.

The radiosonde and MOLTS archives were processed to satisfy needs of this task for water budget calculations over the core monsoon region (Tasks 1.1 and 1.4). Results were presented at the 28th Climate Diagnostics and Prediction Workshop in Reno, NV (Oct. 03).

Accomplishments for the next 3 tasks are combined:
Task 3.1 Examine climatological aspects of Gulf of California moisture surges.
Task 3.3 Examine spatial-temporal relationships between surge events, atmospheric circulation and precipitation.
Task 3.4 Publish the results of research carried out under Task 3.

We acquired, formatted and processed an archive of hourly surface station data for the US and Mexico (1977-present) in preparation for several studies of GOC surge / precipitation relationships.

We completed a study of relationships between Gulf of California moisture surges and precipitation in southwestern North America (Higgins et al. 2003) using the archive of surface observations (dewpoint, wind speed, wind direction) and the US_Mexico observed precipitation database developed by Higgins, Shi and Yarosh under a separate activity at CPC. Gulf of California surges were related to tropical easterly waves and midlatitude westerly waves. A key result of the study is that the response to surges in Arizona / New Mexico strongly depends on the strength and location of the monsoon anticyclone. The manuscript was submitted to *Journal of Climate*

PRESENTATIONS AND PUBLICATIONS:

Journal Articles (peer-reviewed):

Higgins, R. W., W. Shi and C. Hain, 2003: Relationships between Gulf of California moisture surges and precipitation in the southwestern United States. *J. Climate* (submitted)

Conference Presentations / Preprints:

Higgins, R.W., W. Shi and C. Hain, 2003: Relationships between Gulf of California Moisture Surges and Precipitation in the Southwestern United States. 28th Annual Climate Diagnostics and Prediction Workshop, Reno, NV, Oct 20-24

Higgins, R. W., 2003: Overview of the North American Monsoon Experiment (NAME). AMS Symposium on Observing and Understanding the Variability of Water in Weather and Climate, 83rd AMS Annual Meeting, Long Beach, CA,, (Feb 2003)

Higgins, R. W., and the NAME SWG, 2003: The North American Monsoon Experiment (NAME): Status and Plans. 28th Annual Climate Diagnostics and Prediction Workshop, Reno, NV, Oct 20-24

Yarosh, E., W. Shi, and R. W. Higgins, 2002. Long-term observed daily water budget parameters for the North American Monsoon Experiment. 27th Climate Diagnostics and Prediction Workshop, Fairfax VA, October 21-25.

Yarosh, E., R. W. Higgins and W. Shi, 2003: Climate of atmospheric water budget over North American monsoon area as seen from radiosonde observations.. 28th Annual Climate Diagnostics and Prediction Workshop, Reno, NV, Oct 20-24

Meetings Attended:
27th CDPW, GMU, Fairfax, VA (Oct 02)
NAME SWG-3, GMU, Fairfax, VA (Oct 02)
CPAW Workshop, Alexandria, VA (Oct 02)
NAME SWG-4, Boulder, CO (Jan 03)
83rd AMS Annual Meeting, Long Beach, CA, (Feb 03)
Pacific Decadal Variability, Alexandria, VA, (Feb 03)
NSF Tier 1 Network, Arlington, VA (Mar 03)
6th VAMOS Panel Meeting, Miami, FL, (Apr. 03)
NASA Subseasonal Workshop, UMD, (Jun 03)
NAME Modeling and Data Assimilation Workshop, Greenbelt, MD, (Jun 03)
GAPP PI Meeting, Seattle, WA (Jul 03)
CLIVAR Pan Am Panel Meeting, Seattle, WA (Aug. 03)
NWS Climate Services Focal Point Workshop, Reno, NV (Sep. 03)
CLIVAR Pan American PI Meeting, Boulder, CO (Sep. 03)

28th Climate Diagnostics and Prediction Workshop, Reno, NV (Oct. 03)

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